Critical Areas Report for Single Family Residence located at 1808 Killarney Way Bellevue, Washington 98004

Critical Areas Identification

The site in question contains steep slope critical areas on the West portion of the site. There are no additional critical areas on the site. See attached Site Survey.

Standards for proposed Modification

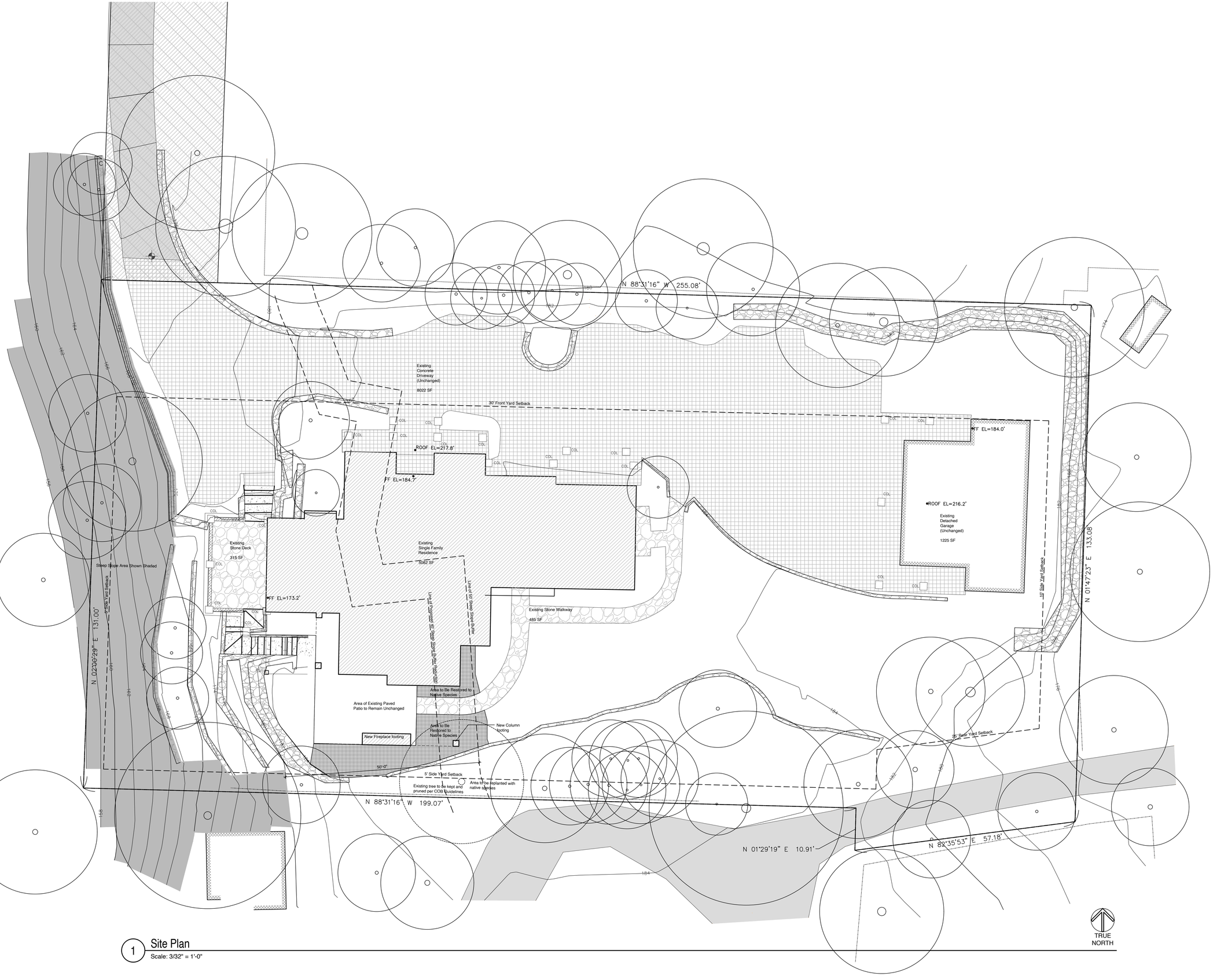
No work will be done within the steep slope critical areas. However, we will be adding some concrete footings within the 50' buffer area from the top of the slope of the critical areas. We are proposing a buffer reduction to 40' which will accommodate the new column footing required to support the second story addition we are proposing. The geotechnical report contains a slope stability analysis that deems our proposal within the steep slope buffer area to be safe. See attached Geotechnical report.

Functional Lift Analysis

The area of site disturbance is currently a paved deck area and existing lawn. The area of ground disturbance, including the area below the proposed 2nd story addition, is currently degraded as it contains invasive species, lawn, and paving. We will the remove existing degradation and replant with native species to restore this area to back to its native elements. This will provide a lift and improve habitats function by providing more native species within the buffer area than it previously contained. See attached Mitigation Plan.

Mitigation and Restoration

The area of disturbance will be restored from invasive species to native species so that the resulting project will contain more native species than was originally on the site. See attached Mitigation Plan.



1 Site Plan

Scale: 3/32" = 1'-0"

HhLodesign
minimalist.spatial.creation

215 West Crockett Street
Seattle, Washington 98119
206.229.8082

DRAWN BY

DESIGN BY

CHECKED BY

APPROVED BY

DATE
October 05, 2022

REVISIONS

HARRISON RESIDENCE

1808 Killarney Way
Bellevue, Washington

8190 REGISTERED ARCHITECT
HENRY H. LO
STATE OF WASHINGTON

Mitigation Plan

A-1.1

PROJECT DATA	PROPERTY DATA	CONSTRUCTION DATA	CONSTRUCTION DATA	ENERGY DATA
OWNER Andrew and Amy Harrison 1808 Killarney Way Bellevue, Washington ARCHITECT HhLodesign 215 W. Crockett St. Seattle, WA 98119 Contact: Henry H Lo 206-229-8082 CONTRACTOR TBD Phone Fax Email CONTACT: STRUCTURAL ENGINEER TBD Phone Fax Email CONTACT:	PROJECT ADDRESS 1808 Killarney Way Bellevue, Washington ZONING DESIGNATION R-1.8 HEIGHT LIMIT 30'-0" to Flat Roof 35'-0" to Ridge of Pitched Roof SETBACKS Front Yard Setback 30'-0" Rear Yard Setback 25'-0" Side Yard Setback 5'-0" min. 15'-0" total LOT AREA 32,668 sq ft ASSESSOR'S TAX NUMBER 052405-9299 LEGAL DESCRIPTION Lot 1 of City of Bellevue Short Plat No. 79-36, As Recorded August 13, 1979 Under recording No. 7908130535, records of King County Auditor	SCOPE OF WORK 2nd Story Addition and Alteration to existing single family residence per plan. Buffer reduction to 40' required to accommodate addition of new column footing within existing steep slope buffer. LOT COVERAGE Lot Area 32,668 sq ft Percent Allowable (Structure) 35% = 11,433.8 sq ft Main House Roof Area 5082 sq ft Garage Roof Area 1225 sq ft Total Roof Area 6307 sq ft Percent Allowable (Impervious) 45% = 14,700.6 sq ft Roof Area 6307 sq ft Concrete Driveway area 6455 sq ft Stone decks and walks 800 sq ft Total Impervious Surface Proposed 13,562 sq ft FLOOR AREA RATIO Lot Area 32,668 sq ft FAR Allowable 50% = 16,334 sq ft Total Floor Area Proposed 8324 sq ft	AREA SUMMARY Conditioned Space Lower Level (existing) 2314 sq ft Main Level (existing) 2413 sq ft Upper Level (existing) 2966 sq ft Total (Existing) 7693 sq ft Upper Level (New) 631 sq ft Total (New) 631 sq ft Total (Combined) 8324 sq ft	New Conditioned Square footage added: 631 sq ft Small Dwelling Unit 3 Energy Credits Required. Options 3.5 and 5.4 Selected All new and altered building elements to have the following values: Glazing U-Factor (Vertical): 0.30 Glazing U-Factor (Overhead): 0.50 Door U-Factor: 0.30 Entire Slab: R-10 Below grade walls (interior): R-21 Below grade walls (exterior): R-10 Above grade walls: R-21 Floor Insulation: R-38 Ceilings: R-49 or R-38 adv Vaulted Ceilings: R-38 3.5 (1.5 Credits): Air-source, centrally ducted heat pump with minimum HSPF of 11.0. 5.4 (1.5 Credits): For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier I of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.

N 88°31'16" W 255.08'

Existing Concrete Driveway (Unchanged)
8022 SF

30' Front Yard Setback

ROOF EL=217.8'

FF EL=184.7'

FF EL=184.0'

ROOF EL=216.2'

Existing Detached Garage (Unchanged)
1225 SF

Existing Stone Deck
315 SF

Existing Single Family Residence
5082 SF

FF EL=173.2'

Steep Slope Area Shown Shaded

Limit of Steep Slope Buffer Reduction

Existing Stone Walkway
485 SF

Area of Existing Covered Patio

Area of 2nd Story Addition Above, Beyond Existing Covered Patio

Area of Ground Disturbance in Critical Areas Buffer

New Fireplace footing and Column footing

Limit of Steep Slope Buffer

10' Side Yard Setback

5' Side Yard Setback

30' Rear Yard Setback

50'-0"

Existing tree to be retained and pruned per COB Guidelines

N 02°06'29" E 131.00'

N 01°47'23" E 133.08'

N 88°31'16" W 199.07'

N 01°29'19" E 10.91'

N 82°35'53" E 57.18'

TRUE NORTH

1 Site Plan
Scale: 3/32" = 1'-0"

HhLodesign
minimalist.spatial.creation

215 West Crockett Street
Seattle, Washington 98119
206.229.8082

DRAWN BY

DESIGN BY

CHECKED BY

APPROVED BY

DATE
October 05, 2022

REVISIONS

HARRISON RESIDENCE

1808 Killarney Way
Bellevue, Washington

8190 REGISTERED ARCHITECT
HENRY H. LO
STATE OF WASHINGTON

Site Plan B

A-1.0

CITY OF BELLEVUE

MyBuildingPermit.com
a service of eCityGov.net

Land Use Application #1185149 - Harrison Bellevue Residence

Applicant

First Name	Last Name	Company Name
Henry	Lo	HhLodesign

Number	Street	Apartment or Suite Number	E-mail Address
215	W. Crockett St.		hhlodesign@gmail.com

City	State	Zip	Phone Number	Extension
Seattle	WA	98119	(206) 229-8082	

Contractor

Company Name

Number | Street | Apartment or Suite Number

City | State | Zip | Phone Number | Extension

State License Number | License Expiration Date | UBI # | E-mail Address

Project Location

Number	Street	Floor Number	Suite or Room Number
1808	KILLARNEY WAY		

City	Zip Code	County Parcel Number
BELLEVUE	98004	0524059299

Associated Building Permit Number | Tenant Name

Additional Information (i.e. equipment location or special instructions).

Work Location

Property Owner

First Name	Last Name or Company Name
Andrew R & Amy E	Harrison

Number	Street	Apartment or Suite Number
1608	106TH AVE SE	

City	State	Zip
BELLEVUE	WA	98004

Certification Statement - The applicant states:

I certify that I am the owner of this property or the owner's authorized agent. If acting as an authorized agent, I further certify that I have full power and authority to file this application and to perform, on behalf of the owner, all acts required to enable the jurisdiction to process and review such application. I have furnished true and correct information. I will comply with all provisions of law and ordinance governing this type of application. If the scope of work requires a licensed contractor to perform the work, the information will be provided prior to permit issuance.

Date Submitted: 8/9/2022 **Submitted By:** Henry Lo

CITY OF BELLEVUE

Land Use Application #1185149 - Harrison Bellevue Residence

Project Contact

Company Name: HhLodesign

Name: Henry Lo **Email:** hhlodesign@gmail.com

Address: 215 W. Crockett St. **Phone #:** (206) 229-8082
Seattle WA 98119

Project Type	Activity Type	Scope of Work
Single Family Residential	Critical Areas	Critical Areas Permit

Project Name: Harrison Bellevue Residence

Description of Work: 631 SF second story addition to an existing 7693 SF single family residence. Ground disturbance to be footings for support column and fireplace only. 1 Existing tree in Buffer area to be removed.

Project Details

Critical Area Information

Geologic hazard

Customer Feedback

No, I am not willing to share my feedback through an online survey

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

April 20, 2022

JN 21509

Andrew and Amy Harrison
1808 Killarney Way
Bellevue, Washington 98004
via email: Andrew.harrison@alaskaair.com

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Addition to Existing Single-Family Residence
1808 Killarney Way
Bellevue, Washington

Greetings:

Attached to this transmittal letter is our geotechnical engineering report for the addition to existing single-family residence to be constructed in Bellevue, Washington. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design considerations for foundations, retaining walls, subsurface drainage, and temporary excavations. This work was authorized by your acceptance of our proposal, P-11036, dated November 22, 2021.

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

D. Robert Ward, P.E.
Principal

cc: HhLodesign – Henry Lo
via email: hhlodesign@gmail.com

DRW:kg

GEOTECHNICAL ENGINEERING STUDY
Addition to Existing Single-Family Residence
1808 Killarney Way
Bellevue, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed addition to existing single-family residence to be located in Bellevue.

We were provided with architectural plans and a topographic map. HhLo Design developed these plans, which are dated September 2021. The topographic map was prepared by Terrane dated December 20, 2021. Based on this information, we understand that an addition is proposed onto the western portion of the southern side of the existing residence. The lower floor of the addition will be at the main level grade of the existing residence; there is currently a flat patio/terrace area in this location. The addition will also have an upper level (second floor) over its main level.

The slope on the western end of the property meets the City of Bellevue's definition of a Steep Slope Geologic Hazard Area. We expect that a Critical Area Land Use Permit (CALUP) will be applied for to allow for the necessary buffer reductions and development near this critical area.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site in the southwestern portion of Bellevue. The site is nearly rectangular, having a length in the north-south direction of approximately 132 feet and a depth of approximately 255 feet. A driveway extends from the northwestern corner of the site down to Killarney Way, but the site does not border Killarney Way.

A large majority of the site is relatively flat. A detached garage is located on the eastern end of the site and a residence is located on the western portion, albeit about 45 to 50 feet from the western property line. A relatively flat paver driveway is located along the northern portion of the property which abuts the residence and garage. However, there is a steep slope that declines to the west on the western end of the property and west of the residence. The base of the slope ends near the eastern side of a neighboring residence. The top of much of the slope is in the range of elevation 170 feet, which is just below the basement level of the residence. However, via some tiered rockeries, the slope rises up to about elevation 184 feet at the southwestern portion residence; this level is essentially equal to the main level of the residence. A patio/outdoor kitchen is located at the top of this southwestern slope. A test hole was excavated next to a column that supports the southwestern side of an existing roof structure that extends over the patio/outdoor kitchen; this column is located fairly close to the slope. The concrete foundation for this column was found to be bottomed about 2 feet below the patio level.

The steep western slope has an inclination in the range of about 60 to 70 percent and a total height ranging from about 30 to 40 feet. Much of this slope is forested. As discussed above, the top of the steep slope consists of a series of tiered rockeries off the southwest corner of the existing

residence. The City of Bellevue Municipal Code classifies the western slope as a Steep Slope Geologic Hazard Area, which is defined as any slope with an inclination of 40 percent or more that have a rise of at least 10 feet and exceed 1,000 square feet in area.

SUBSURFACE

The subsurface conditions were explored by drilling two test borings at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The test borings were drilled on January 20, 2022 using a track-mounted, hollow-stem auger drill. Samples were taken at approximate 2.5- or 5-foot intervals with a standard penetration sampler. This split-spoon sampler, which has a 2-inch outside diameter, is driven into the soil with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler a given distance is an indication of the soil density or consistency. A geotechnical engineer from our staff observed the drilling process, logged the test borings, and obtained representative samples of the soil encountered. The Test Boring Logs are attached as Plates 3 and 4.

Soil Conditions

The upper soil revealed in the test borings consisted of about 2 to 7 feet of generally loose fill soil; the most fill was revealed near the western steep slope. Native sand, with a portion containing some silt, was revealed below the fill. This sand was loose to depths of about 4 to 8 feet, at which depth the sand became medium-dense to dense. The sand became very dense at depths of about 10 to 15 feet.

No obstructions were revealed by our explorations. However, debris, buried utilities, and old foundation and slab elements are commonly encountered on sites that have had previous development.

Groundwater Conditions

No groundwater seepage was observed in the test borings. Although groundwater levels encountered during drilling can be deceptive, because seepage into the boring can be blocked or slowed by the auger itself. We do not believe groundwater will be a significant consideration for this project.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. Where a transition in soil type occurred between samples in the borings, the depth of the transition was interpreted. The relative densities and moisture descriptions indicated on the test pit boring logs are interpretive descriptions based on the conditions observed during excavation drilling.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test borings conducted for this study encountered approximately 4 to 8 feet of unsuitable, loose soil at the ground surface overlying competent, medium-dense to dense (or denser) sand soils. The loose soil is not suitable to support any building loads. The building loads should bear on or into the competent underlying sand soils.

Up to about 8 feet of loose soil was revealed in test boring located near the top of the steep western slope, although the core of the slope consists of competent medium-dense to dense or denser native sands. We completed a slope stability analysis of the steep slope off the southwest corner of the residence in the area of the existing patio and rockery where the new addition is proposed. Based on this analysis (attached to the end of this report), simulated slope failures extending into the competent underlying medium-dense to dense sands have factors of safety of at least 1.5 and 1.2 for static and seismic conditions, respectively. Therefore, although there is some potential for slope movement of the loose near-surface soils along the top of the steep slope, because the foundations for the proposed addition will bear on or into the competent underlying medium-dense to dense core slope soils, it is our opinion that such potential movement of the loose surficial soils will not affect the proposed addition. An expanded ***Critical Areas Discussion*** is presented later in this report regarding the western steep slope and its relation to the proposed residence addition.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, the access roads should follow the alignment of planned pavements. Trucks should not be allowed to drive off of the rock-covered areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking, cleaning, and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a build up of excessive water vapor within the planned structure.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

BELLEVUE CRITICAL AREAS DISCUSSION

Per Bellevue Land Use Code (LUC) Section 20.25.120.A, there are numerous criteria for why a site could be deemed a geologic "Critical Area." The western end of the subject site appears to qualify as a Critical Area (Steep Slope) per section 20.25.120.A.2 of the Bellevue Land Use Code (LUC) as follows:

> LUC 20.25.120.A.2 – Steep Slopes. Slopes of 40 percent or more that have a rise of at least 10 feet and exceed 1,000 square feet in area.

Per LUC 20.25H.120.B&C, the default minimum buffer from the top of a Steep Slope is 50 feet. A discussion of the project with regards to the Steep Slope designation is discussed below. However, a modification to this minimum buffer can be obtained per code. We point out that existing patio and decks off the south and southwest sides of the existing residence have little to no setback from the top of the western adjacent steep slope Critical Area. Therefore, these are currently located well within the 50-foot buffer without any signs of geotechnical issues. It is our professional opinion that this addition project can be constructed where planned, which is also well within the 50-foot-buffer. The main reasons for this is because the core of the western slope is medium-dense to dense, or denser sand, and the slope stability analysis confirmed that foundations for this project will be stable if the bear on these core soils. An expanded discussion regarding this lessened setback is located below with regards to this buffer modification.

As part of the Bellevue Municipal Code, there are "performance standards" that need to be met per LUC 20.25H.125 because of the buffer modifications (less than the default distance of 50 feet from the top of a steep slope area). We have listed numerous standards that are included in this section of the code, and we have provided our comments/conclusions to each standard in italics following the standard.

- Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography. *The proposed addition project will not alter the existing western steep slope.*

- Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation. *The proposed new addition will be located within the existing flat patio area near the top of the steep slope and will not alter the natural landforms and vegetation.*

- The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties. *This project will increase the stability of the addition area in or opinion*

by extending the building loads currently bearing on the loose fill soils, down to the underlying medium-dense to dense sands that comprise the core of the steep slope. Thus, it is our opinion that the proposed development will decrease, not increase, the risk or need for increased buffers on neighboring properties.

- The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes where graded slopes would result in increased disturbance as compared to use of retaining wall. *As discussed above, the proposed development will not include any retaining walls or artificially graded slopes. The development will be located within the existing flat patio area east of the steep slope.*

- Development shall be designed to minimize impervious surfaces within the critical area and critical area buffer. *The proposed development area is already covered by impervious roof and patio surfaces located within the buffer. The new impervious areas will need to be managed and connected to the existing surface and subsurface drainage system. Recommendations for subsurface drainage systems for the addition are presented in this report. No new impervious surfaces are being proposed to be constructed on the western steep slope as part of the project.*

- Building foundation walls shall be utilized as retaining walls rather than rockeries or retaining structures built separately and away from the building wherever feasible. T*his is being done for this project.*

- On slopes in excess of 40 percent, use of pole-type construction which conforms to the existing topography is required where feasible. If pole-type construction is not technically feasible, the structure must be tiered to conform to the existing topography and to minimize topographic modification. *The proposed development will not disturb the adjacent steep slope in excess of 40 percent inclination. The proposed additions will be located in the flat buffer upslope and east of the western steep slope. We understand the final grade will match that of the existing level patio.*

- On slopes in excess of 40 percent, piled deck support structures are required where technically feasible for parking or garages over fill-based construction types. *No parking or garages are proposed as part of this project.*

- Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. (Ord. 5680, 6-26-06, § 3). *The proposed additions will be located within the existing development area. We understand that a mitigation and restoration plan will be included in the final permitted project plans.*

Modifications to geologic hazard critical areas and critical area buffers shall only be approved if the Director determines that the modification meets several criteria noted in section 20.25H.145 of the Bellevue LUC. It is our professional opinion that the proposed modification is very suitable from a geotechnical engineering standpoint. We have noted the criteria in the LUC below, along with our comments/conclusions regarding them that indicate why we believe the modification is suitable.

- The modification will not increase the threat of the geological hazard to adjacent properties over conditions that would exist if the provisions of this part were not modified. *In our opinion, removing the existing building loads from the loose fill soils and extending them down to the*

competent underlying medium-dense to dense sands along the top of the slope will improve the stability of the top of the steep slope and decrease the threat of the geologic hazard to the adjacent properties. Therefore, this criterion is met.

- The modification will not adversely impact other critical areas. *The modification will positively affect the steep slope critical area (improve its stability) southwest of the residence, but it will not adversely impact any other critical areas.*

- The modification is designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than would exist if the provisions of this part were not modified. *As previously discussed, the existing roof support column(s) near the top of the steep slope are currently supported on the loose fill soils placed during the residence's construction, which also over-steepened the top of the steep slope with a series of tiered rockeries. The proposed addition will extend these column loads down to the competent underlying sands. This will improve the stability of the top of the steep slope. Therefore, it is our professional opinion that the hazard to the project is mitigated to a level that the hazard of slope instability is the same or likely less in comparison to the existing condition if no modifications were made.*

- The modification is certified as safe as designed and under anticipated conditions by a qualified engineer or geologist, licensed in the state of Washington. *Once the full architectural and structural plans are developed and our recommendations are incorporated into the design, it is our opinion that the project will be safe as defined by today's code.*

- The applicant provides a geotechnical report prepared by a qualified professional demonstrating that modification of the critical area or critical area buffer will have no adverse impacts on stability of any adjacent slopes and will not impact stability of any existing structures. Geotechnical reporting standards shall comply with requirements developed by the Director in City of Bellevue Submittal Requirements Sheet 25, Geotechnical Report and Stability Analysis Requirements, now or as hereafter amended. *This report itself satisfies this requirement.*

- Any modification complies with recommendations of the geotechnical report with respect to best management practices, construction techniques or other recommendations. *While the project is early in the design phase, we anticipate that our recommendations will be incorporated in the project plans and carried out through construction.*

Bellevue Code also notes that "the Director may approve, or approve with modifications, the proposed modification where the application demonstrates" several criteria. These criteria, along with our comments/conclusions noted in italics, are given below:

- The modifications and performance standards included in the proposal lead to levels of protection of critical area functions and values at least as protective as application of the regulation and standards of the Bellevue Code. *Based on information presented in this report, it is our professional opinion that this statement is true.*

- There are adequate resources to ensure completion of any required mitigation and

monitoring efforts. *The project owner will ultimately need to ensure this, although we believe that adequate resources will be available based on discussions we have had with the owner.*

- The modifications and performance standards included in the proposal are not detrimental to the functions and values of critical areas and critical area buffers off-site. *As previously discussed, we believe the new addition project within the buffer will improve the stability of the top of the steep slope. The steep slope itself, which descends off-site to the west onto the western neighboring properties, will not be disturbed. Therefore, the modifications and performance standards will not be detrimental to the critical area (steep slope) or its buffers (they actually will improve the stability of the steep slope).*

- The resulting development is compatible with other uses and development in the same land use area. *The proposed addition project is located within the footprint of the existing development area and will improve the stability of the slope. Thus, the proposed project is compatible with other development in the area in our opinion.*

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type D (Stiff Soil). As noted in the USGS website, the mapped spectral acceleration value for a 0.2 second (S_s) and 1.0 second period (S_1) equals 1.37g and 0.48g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.64g. The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature and/or the absence of near-surface groundwater.

Sections 1803.5 of the IBC and 11.8 of ASCE 7 require that other seismic-related geotechnical design parameters (seismic surcharge for retaining wall design and slope stability) include the potential effects of the Design Earthquake. The peak ground acceleration for the Design Earthquake is defined in Section 11.2 of ASCE 7 as two-thirds (2/3) of the MCE peak ground acceleration, or 0.43g.

CONVENTIONAL FOUNDATIONS

The proposed structure can be supported on conventional continuous and spread footings bearing on undisturbed, competent, medium-dense to dense native soil. Some overexcavation is likely needed to reach this soil. We recommend that continuous and individual spread footings have minimum widths of 16 and 24 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior

to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

An allowable bearing pressure of 3,000 pounds per square foot (psf) is appropriate for footings supported on the competent native soil. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil will be about 3/4-inch, with differential settlements on the order of 1/2-inch in a distance of 30 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.50
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Lateral Earth Pressure *	35 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.50
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Lateral and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above lateral equivalent fluid pressure. This applies only to walls with level backfill.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired.

The passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

Per IBC Section 1803.5.12, a seismic surcharge load need only be considered in the design of walls over 6 feet in height. A seismic surcharge load would be imposed by adding a uniform lateral pressure to the above-recommended lateral pressure. The recommended seismic surcharge pressure for this project is 8**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The later section entitled ***Drainage Considerations*** should also be reviewed for recommendations related to subsurface drainage behind foundation and retaining walls.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated

water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The recommended wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

The ***General***, ***Slabs-On-Grade***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop firm, non-organic soil or on structural fill. The subgrade soil must be in a firm, non-yielding condition at the time of slab construction or underslab fill placement. Any soft areas encountered should be excavated and replaced with select, imported structural fill.

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI recommends a minimum 10-mil thickness vapor retarder for better durability and long term performance than is provided by 6-mil plastic sheeting that has historically been used. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection.

If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material.

The ***General***, ***Permanent Foundation and Retaining Walls***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

EXCAVATIONS AND SLOPES

Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Temporary cuts to a maximum overall depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. Based upon Washington Administrative Code (WAC) 296, Part N, the upper soil at the subject site would generally be classified as Type B. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 1:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil. In addition, no soil should be placed on or near the steep slope and rockeries to the west of the proposed addition.

DRAINAGE CONSIDERATIONS

Footing drains are only needed for this project if: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or, (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the ***Slabs-On-Grade*** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Providing a few inches of free draining gravel underneath the vapor retarder is also prudent to limit the potential for seepage to build up on top of the vapor retarder.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to the residence should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the ***Foundation and Retaining Walls*** section.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should

not exceed 12 inches, but should be thinner if small, hand-operated compactors are used. We recommend testing structural fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended levels of relative compaction for compacted fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath slabs or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test borings are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking samples in test borings. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

The recommendations presented in this report are directed toward the protection of only the proposed addition from damage due to slope movement. Predicting the future behavior of steep slopes and the potential effects of development on their stability is an inexact and imperfect science that is currently based mostly on the past behavior of slopes with similar characteristics. Landslides and soil movement can occur on steep slopes before, during, or after the development of property. The owner of any property containing, or located close to steep slopes must ultimately accept the possibility that some slope movement could occur, resulting in possible loss of ground. However, such potential movement of the western steep slope would not affect the addition because its foundations will be on or embedded into competent, landslide-resistant soil.

This report has been prepared for the exclusive use of Andrew and Amy Harrison and their representatives, for specific application to this project and site. Our conclusions and

recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

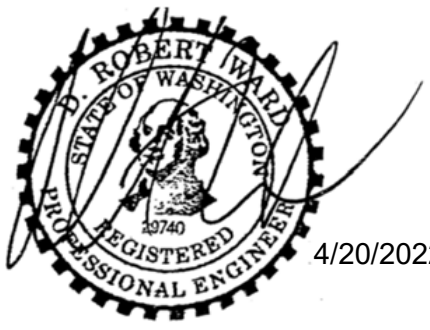
The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 4	Test Boring Logs
Attachments	Slope Stability Analysis Printout

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.



4/20/2022

D. Robert Ward, P.E.
Principal

DRW:kg

NORTH

(Source: Microsoft MapPoint, 2013)

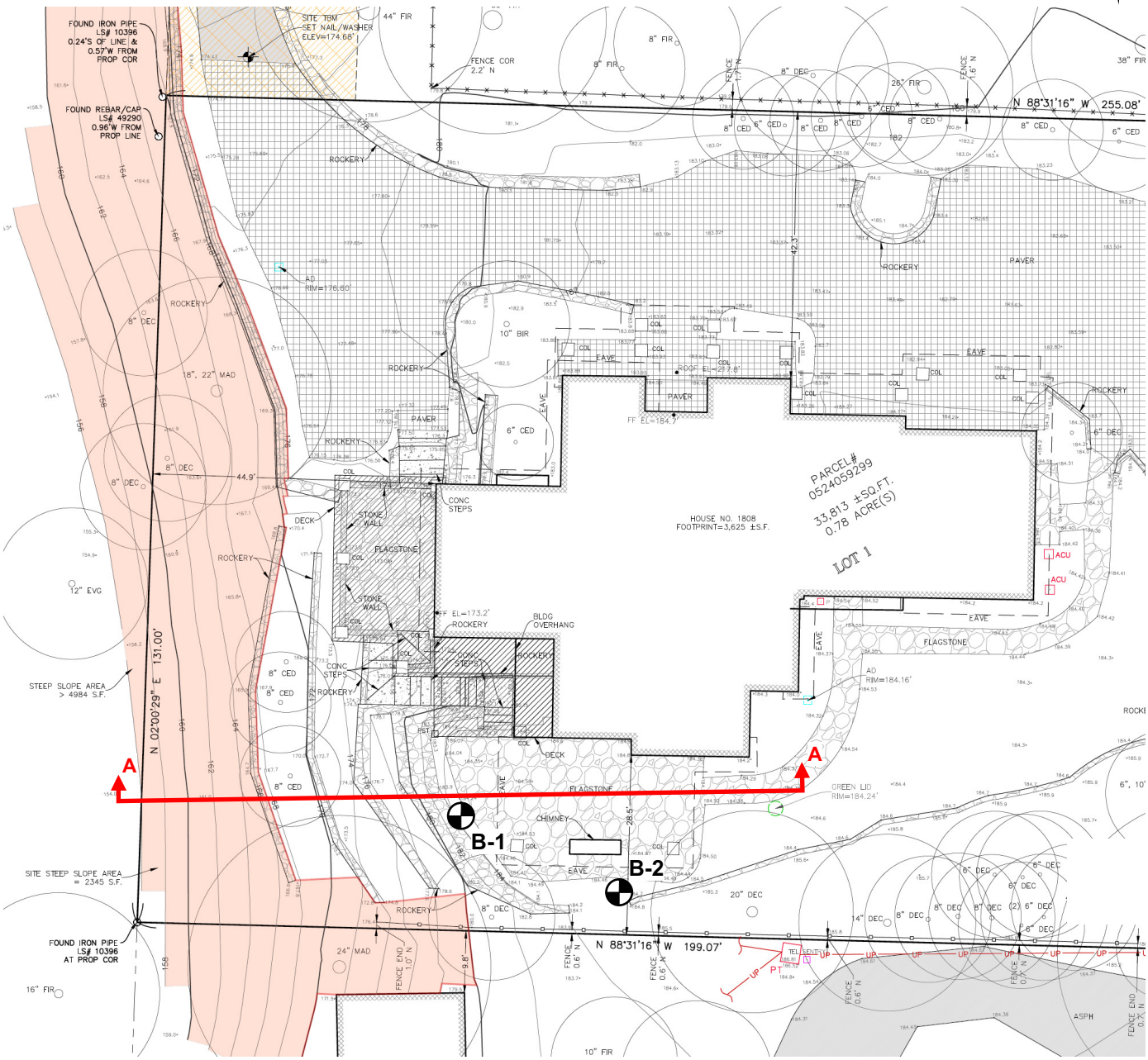
GEOTECH CONSULTANTS, INC.

VICINITY MAP

1808 Killarney Way
Bellevue, Washington

Job No:	Date:		Plate:
21509	Apr. 2022		1

NORTH



Legend:

Test Boring Location

A A Slope Stability Analysis Cross Section A - A

GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

1808 Killarney Way
Bellevue, Washington

Job No:	Date:		Plate:
21509	Apr. 2022	No Scale	2

BORING 1

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
						Intermixed brown and dark-brown slightly silty SAND with silt, gravel, and organics, fine- to medium-grained, moist, loose **(FILL)**
			7	1	FILL	
5			11	2		-with wood debris
			10	3	SP	Brown SAND with trace silt and gravel, fine-grained, moist, loose
10			31	4	SM	Brown with rust mottling, silty SAND with trace roots, very fine-grained, very moist, medium-dense -becomes dense
			38	5		Brown SAND with occasional gravel, fine- to medium-grained, moist, dense -with 4-inch, very fine-grained, silty seam
15			81	6	SP	-becomes gray, fine-grained, very dense, no gravel -with 6-inch sandy silt seam
20			68	7		-becomes fine- to medium-grained
25						

*** Test boring was terminated at 21.5 feet on January 20, 2022.**

*** No groundwater seepage was encountered during drilling.**

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

1808 Killarney Way
Bellevue, Washington

Job No:	Date:	Logged by:	Plate:
21509	Apr. 2022	ASM	3

BORING 2

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
					FILL	Dark-brown silty SAND with gravel and organics, fine- to medium-grained, moist, loose **(FILL)**
			9	1	SM SP	Brown slightly silty SAND with gravel, fine-grained, moist, loose
5			**39	2		Gray-brown gravelly SAND with silt, fine- to coarse-grained, moist, medium-dense
			24	3		-becomes fine-grained, no gravel -with 4-inch silty seam
10			50/6"	4	SP	-becomes gravelly, very dense
15			61	5		-with 2-inch silty seam
20						
25						

*** Test boring was terminated at 16.5 feet on January 20, 2022.**
*** No groundwater seepage was encountered during drilling.**
**** Overstated blow counts - sampler driving on gravels.**

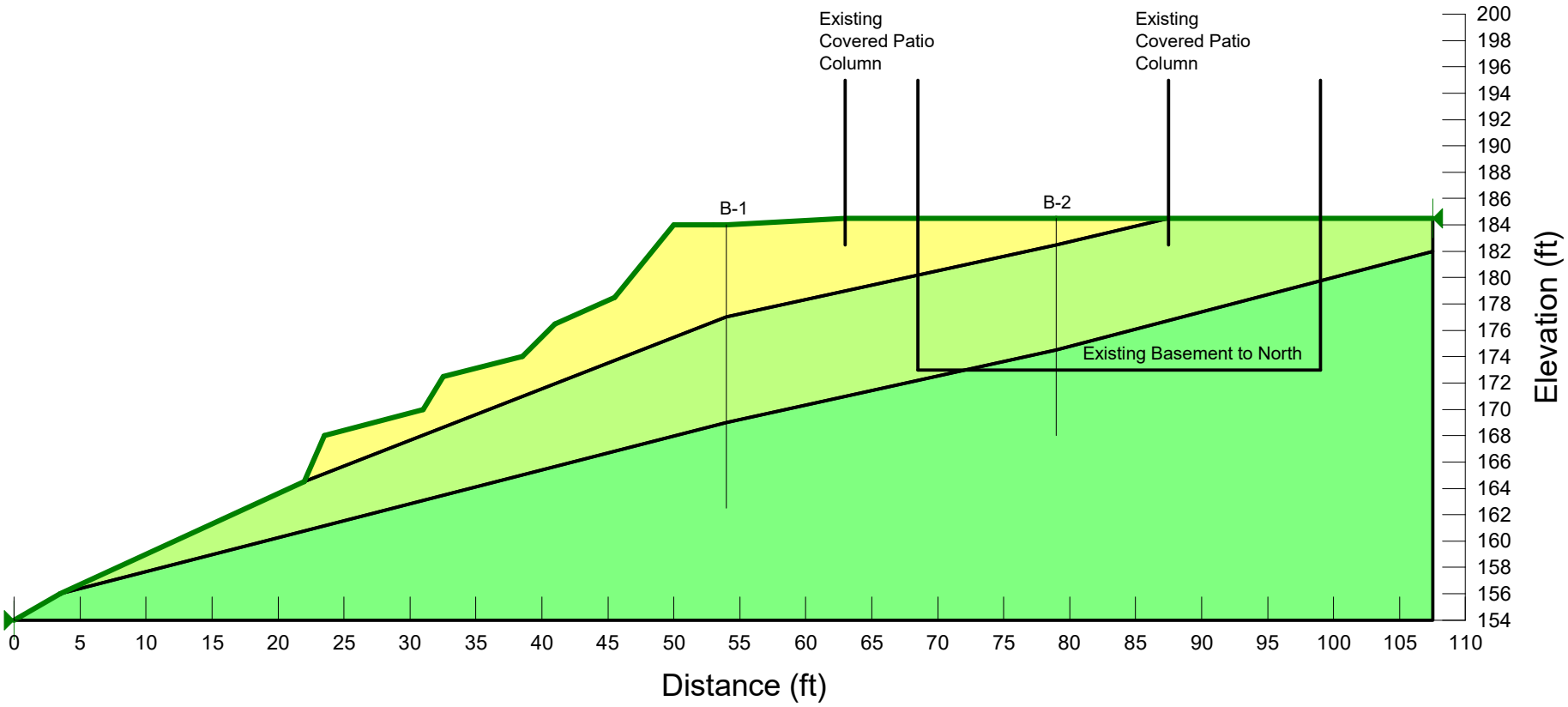
GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

1808 Killarney Way
Bellevue, Washington

Job No:	Date:	Logged by:	Plate:
21509	Apr. 2022	ASM	4

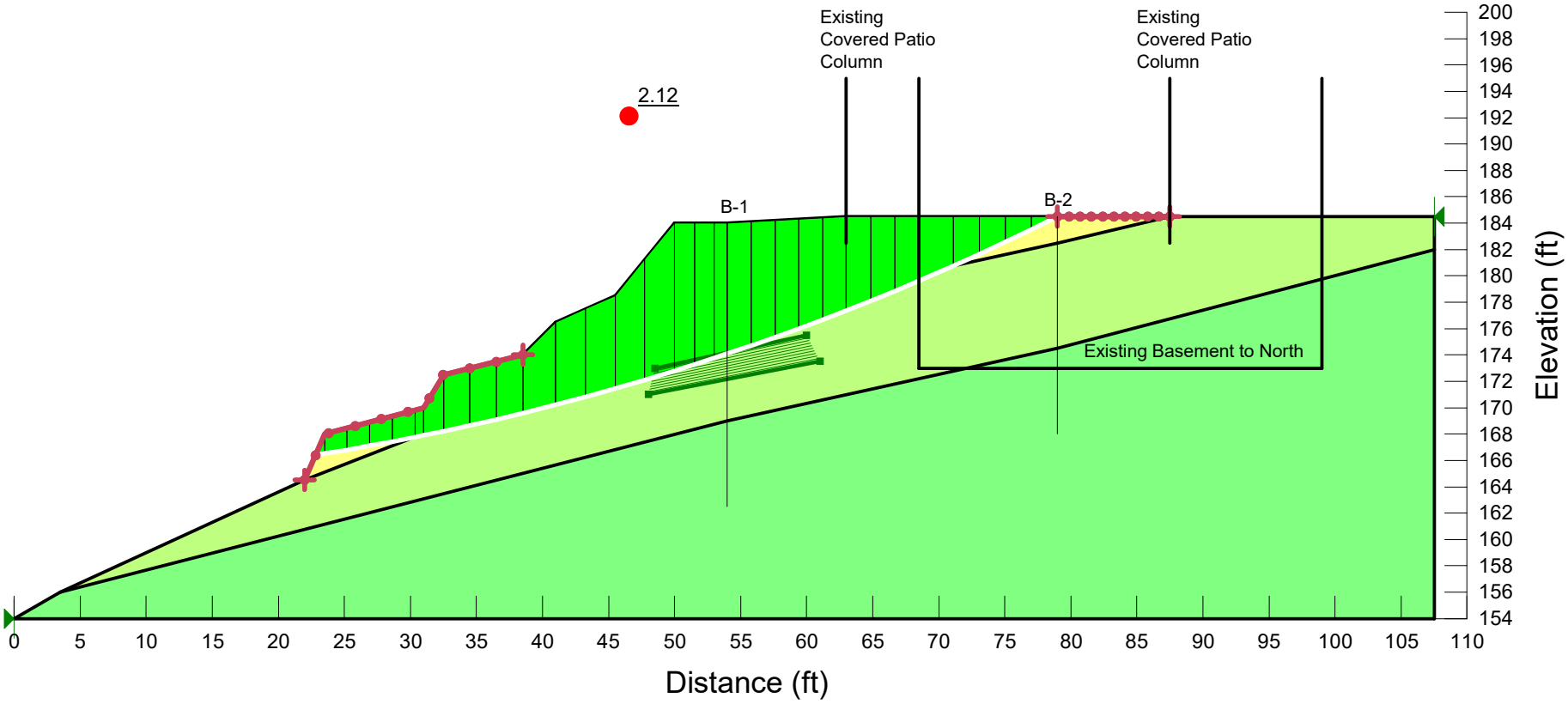
Cross Section A - A



Materials

- Loose FILL
- Medium-dense to Dense Slightly Silty SAND
- Very Dense SAND

Static



Materials

- Loose FILL
- Medium-dense to Dense Slightly Silty SAND
- Very Dense SAND

Static

File Information

File Version: 8.15
Title: 21509 - Harrison
Created By: Adam Moyer
Last Edited By: Adam Moyer
Revision Number: 33
Date: 4/19/2022
Time: 9:48:00 AM
Tool Version: 8.15.6.13446
File Name: 21509 Slope Stability Analysis.gsz
Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2021 Jobs\21509 Harrison (DRW)\
Last Solved Date: 4/19/2022
Last Solved Time: 9:50:39 AM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: (none)
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 28 °
Phi-B: 0 °

Medium-dense to Dense Slightly Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 35 °
Phi-B: 0 °

Very Dense SAND

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 38 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (22, 164.5) ft
Left-Zone Right Coordinate: (38.5, 174) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (79, 184.5) ft
Right-Zone Right Coordinate: (87.5, 184.5) ft
Right-Zone Increment: 10

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 154) ft
Right Coordinate: (107.5, 184.5) ft

Points

	X (ft)	Y (ft)
Point 1	0	154
Point 2	3.5	156
Point 3	22	164.5
Point 4	23.5	168
Point 5	31	170
Point 6	32.5	172.5
Point 7	38.5	174
Point 8	41	176.5
Point 9	45.5	178.5
Point 10	50	184
Point 11	53	184
Point 12	54	184
Point 13	63	184.5
Point 14	68.5	184.5
Point 15	68.5	173
Point 16	79	184.5
Point 17	87.5	184.5
Point 18	99	184.5
Point 19	99	173
Point 20	107.5	184.5
Point 21	54	177
Point 22	54	174
Point 23	54	169
Point 24	54	162.5
Point 25	79	182.5
Point 26	79	180
Point 27	79	174.5
Point 28	79	168
Point 29	107.5	154
Point 30	107.5	182

Regions

	Material	Points	Area (ft^2)
Region 1	Loose FILL	3,21,25,17,16,14,13,12,11,10,9,8,7,6,5,4	262.75
Region 2	Medium-dense to Dense Slightly Silty SAND	2,3,21,25,17,18,20,30,27,23	592
Region 3	Very Dense SAND	2,1,29,30,27,23	1,567.6

Current Slip Surface

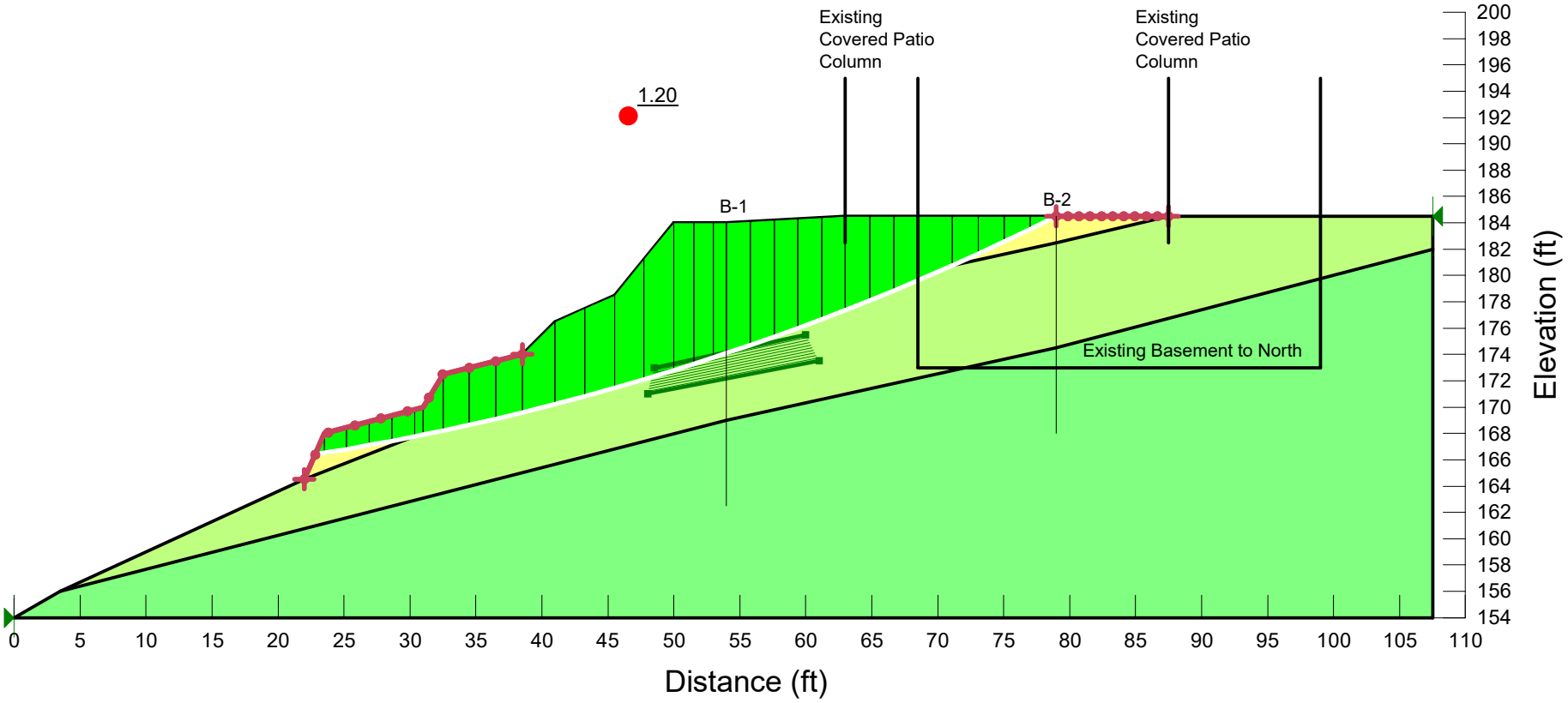
Slip Surface: 131
F of S: 2.12
Volume: 308.4052 ft³
Weight: 37,349.633 lbs
Resisting Moment: 4,729,332.7 lbs-ft
Activating Moment: 2,233,438.7 lbs-ft
Resisting Force: 23,161.171 lbs
Activating Force: 10,939.037 lbs
F of S Rank (Analysis): 1 of 1,331 slip surfaces
F of S Rank (Query): 1 of 1,331 slip surfaces
Exit: (22.814235, 166.39988) ft
Entry: (79, 184.5) ft
Radius: 193.90569 ft
Center: (-7.8573, 357.86444) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	23.157118	166.45544	0	85.95709	45.704196	0
Slice 2	24.355249	166.65508	0	181.95562	96.747519	0
Slice 3	26.065748	166.95113	0	200.9688	106.857	0
Slice 4	27.776246	167.26299	0	217.96098	115.89191	0
Slice 5	29.486744	167.59074	0	232.86158	123.8147	0
Slice 6	30.670997	167.82529	0	241.86054	169.35257	0
Slice 7	31.75	168.04849	0	371.28067	259.97352	0
Slice 8	33.5	168.4233	0	502.5339	351.87802	0
Slice 9	35.5	168.87102	0	510.19667	357.24356	0
Slice 10	37.5	169.34103	0	514.10202	359.97811	0
Slice 11	39.75	169.89821	0	620.1446	434.22993	0
Slice 12	42.125	170.51494	0	744.88095	521.57126	0
Slice 13	44.375	171.12976	0	782.98483	548.25188	0
Slice 14	46.625	171.7738	0	912.9178	639.23192	0
Slice 15	48.875	172.44739	0	1,132.5337	793.00865	0
Slice 16	50.75	173.02942	0	1,209.7102	847.04822	0
Slice 17	52.25	173.51176	0	1,149.1771	804.66243	0
Slice 18	53.5	173.92308	0	1,098.196	768.9651	0
Slice 19	54.9	174.39772	0	1,044.9078	731.65232	0

Slice 20	56.7	175.02335	0	979.15191	685.60955	0
Slice 21	58.5	175.66891	0	912.60081	639.00997	0
Slice 22	60.3	176.33461	0	845.35875	591.92657	0
Slice 23	62.1	177.02068	0	777.46383	544.38603	0
Slice 24	63.916667	177.73409	0	702.92952	492.19655	0
Slice 25	65.75	178.47547	0	621.72044	435.33334	0
Slice 26	67.583333	179.23874	0	539.59888	377.8312	0
Slice 27	69.799313	180.19379	0	438.44991	307.00593	0
Slice 28	72.086299	181.20866	0	340.84757	181.23187	0
Slice 29	74.061642	182.11599	0	248.32894	132.03884	0
Slice 30	76.036985	183.05034	0	152.13801	80.893217	0
Slice 31	78.012328	184.01217	0	51.604393	27.438543	0

Seismic



Materials

- Loose FILL
- Medium-dense to Dense Slightly Silty SAND
- Very Dense SAND

Seismic

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Revision Number: 33
Date: 4/19/2022
Time: 9:48:00 AM
Tool Version: 8.15.6.13446
File Name: 21509 Slope Stability Analysis.gsz
Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2021 Jobs\21509 Harrison (DRW)\
Last Solved Date: 4/19/2022
Last Solved Time: 9:50:40 AM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Seismic

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: (none)
Slip Surface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Resisting Side Maximum Convex Angle: 1 °
    Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 28 °
Phi-B: 0 °

Medium-dense to Dense Slightly Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 35 °
Phi-B: 0 °

Very Dense SAND

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 38 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (22, 164.5) ft
Left-Zone Right Coordinate: (38.5, 174) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (79, 184.5) ft
Right-Zone Right Coordinate: (87.5, 184.5) ft
Right-Zone Increment: 10

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 154) ft
Right Coordinate: (107.5, 184.5) ft

Seismic Coefficients

Horz Seismic Coef.: 0.214

Points

	X (ft)	Y (ft)
Point 1	0	154
Point 2	3.5	156
Point 3	22	164.5
Point 4	23.5	168
Point 5	31	170
Point 6	32.5	172.5
Point 7	38.5	174
Point 8	41	176.5
Point 9	45.5	178.5
Point 10	50	184
Point 11	53	184
Point 12	54	184
Point 13	63	184.5
Point 14	68.5	184.5
Point 15	68.5	173
Point 16	79	184.5
Point 17	87.5	184.5
Point 18	99	184.5
Point 19	99	173
Point 20	107.5	184.5
Point 21	54	177
Point 22	54	174
Point 23	54	169
Point 24	54	162.5
Point 25	79	182.5
Point 26	79	180
Point 27	79	174.5
Point 28	79	168
Point 29	107.5	154
Point 30	107.5	182

Regions

	Material	Points	Area (ft²)
Region 1	Loose FILL	3,21,25,17,16,14,13,12,11,10,9,8,7,6,5,4	262.75
Region 2	Medium-dense to Dense Slightly Silty SAND	2,3,21,25,17,18,20,30,27,23	592
Region 3	Very Dense SAND	2,1,29,30,27,23	1,567.6

Current Slip Surface

Slip Surface: 131
F of S: 1.20
Volume: 308.4052 ft³
Weight: 37,349.633 lbs
Resisting Moment: 4,419,682.2 lbs-ft
Activating Moment: 3,675,728.9 lbs-ft
Resisting Force: 21,687.282 lbs
Activating Force: 18,028.141 lbs
F of S Rank (Analysis): 1 of 1,331 slip surfaces
F of S Rank (Query): 1 of 1,331 slip surfaces
Exit: (22.814235, 166.39988) ft
Entry: (79, 184.5) ft
Radius: 193.90569 ft
Center: (-7.8573, 357.86444) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	23.157118	166.45544	0	83.565857	44.432754	0
Slice 2	24.355249	166.65508	0	177.17727	94.206824	0
Slice 3	26.065748	166.95113	0	196.00829	104.21946	0
Slice 4	27.776246	167.26299	0	212.53372	113.00618	0
Slice 5	29.486744	167.59074	0	226.51425	120.43976	0
Slice 6	30.670997	167.82529	0	249.6097	174.77859	0
Slice 7	31.75	168.04849	0	386.85075	270.87581	0
Slice 8	33.5	168.4233	0	531.75791	372.3409	0
Slice 9	35.5	168.87102	0	550.51037	385.47151	0
Slice 10	37.5	169.34103	0	561.06065	392.8589	0
Slice 11	39.75	169.89821	0	670.65289	469.59621	0
Slice 12	42.125	170.51494	0	789.81932	553.03744	0
Slice 13	44.375	171.12976	0	811.98407	568.55737	0
Slice 14	46.625	171.7738	0	916.09111	641.4539	0
Slice 15	48.875	172.44739	0	1,096.9663	768.10411	0
Slice 16	50.75	173.02942	0	1,140.1725	798.3574	0
Slice	52.25	173.51176	0	1,059.7703	742.05912	0

17						
Slice 18	53.5	173.92308	0	994.46266	696.33025	0
Slice 19	54.9	174.39772	0	927.75396	649.62032	0
Slice 20	56.7	175.02335	0	849.19864	594.61529	0
Slice 21	58.5	175.66891	0	775.4753	542.99365	0
Slice 22	60.3	176.33461	0	706.50934	494.70317	0
Slice 23	62.1	177.02068	0	641.83438	449.41727	0
Slice 24	63.916667	177.73409	0	575.53267	402.99232	0
Slice 25	65.75	178.47547	0	506.78924	354.85764	0
Slice 26	67.583333	179.23874	0	439.59806	307.80988	0
Slice 27	69.799313	180.19379	0	358.38402	250.94319	0
Slice 28	72.086299	181.20866	0	275.17918	146.31537	0
Slice 29	74.061642	182.11599	0	207.55783	110.36046	0
Slice 30	76.036985	183.05034	0	131.89348	70.129008	0
Slice 31	78.012328	184.01217	0	46.299938	24.618114	0

TOPOGRAPHIC & BOUNDARY SURVEY

LEGAL DESCRIPTION

(PER STATUTORY WARRANTY DEED RECORDING# 20190726001234)

LOT 1, OF CITY OF BELLEVUE SHORT PLAT NO. 79-36, ACCORDING TO THE MAP THEREOF RECORDED AUGUST 13, 1979 UNDER RECORDING NO. 7908130535, RECORDS OF KING COUNTY, WASHINGTON.

TOGETHER WITH THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 5, TOWNSHIP 24 NORTH, RANGE 5 EAST, W.M., IN KING COUNTY, WASHINGTON, LYING NORTH OF THE NORTH LINE OF LOT 2, BAKERS WOODLAND ADDITION, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 50 OF PLATS, PAGES 61 AND 62, RECORDS OF KING COUNTY, WASHINGTON, AND LYING SOUTH OF THE SOUTH LINE OF LOT 1, OF SAID SHORT PLAT NO. 79-36, RECORDED UNDER RECORDING NO. 7908130535, RECORDS OF KING COUNTY, WASHINGTON.

EXCEPT THAT PORTION LYING EAST OF THE SOUTHERLY PROLONGATION OF THE EAST LINE OF SAID LOT 1, IN SAID SHORT PLAT.

ALSO EXCEPT THAT PORTION LYING WEST OF A LINE RUNNING SOUTH 01°29'19" WEST FROM THE MOST SOUTHERLY CORNER OF SAID LOT 1, IN SAID SHORT PLAT.

AND TOGETHER WITH A NON-EXCLUSIVE EASEMENT FOR INGRESS, EGRESS AND UTILITIES AS DELINEATED ON SAID SHORT PLAT NO. 79-36.

ALSO TOGETHER WITH A NON-EXCLUSIVE EASEMENT FOR ROADWAY AND UTILITIES OVER THE FOLLOWING DESCRIBED PARCEL:

BEGINNING AT THE NORTHWEST CORNER OF SAID LOT 1;
THENCE SOUTH 88°31'16" EAST, 30.00 FEET;
THENCE NORTH 02°00'29" EAST, 199.99 FEET;
THENCE NORTH 88°31'51" WEST, 30.00 FEET;
THENCE SOUTH 02°00'29" WEST, 199.99 FEET TO THE POINT OF BEGINNING.
SITUATE IN THE COUNTY OF KING, STATE OF WASHINGTON.

BASIS OF BEARINGS

N 02°00'29" E BETWEEN SURVEY MARKERS FOUND ALONG THE EAST SUBDIVISION LINE SEC. 5, T24N, R5E W.M., PER R1.

REFERENCES

R1. CITY OF BELLEVUE SHORT PLAT NO. 79-36, REC. NO. 7908130535, RECORDS OF KING COUNTY, WASHINGTON.
R2. BAKERS WOODLAND ADDITION, VOL. 50 OF PLATS, PGS. 61-62, RECORDS OF KING COUNTY, WASHINGTON.

VERTICAL DATUM

NAVD 88 PER GPS OBSERVATIONS

SURVEYOR'S NOTES

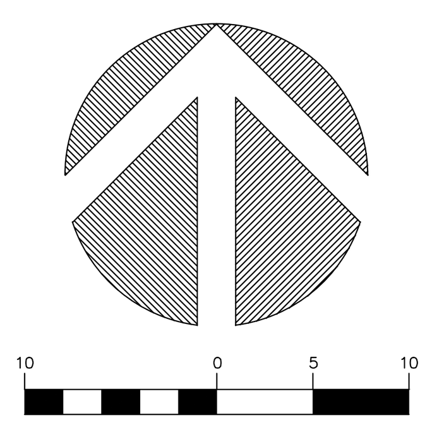
1. THE TOPOGRAPHIC SURVEY SHOWN HEREON WAS PERFORMED IN DECEMBER OF 2021. THE FIELD DATA WAS COLLECTED AND RECORDED ON MAGNETIC MEDIA THROUGH AN ELECTRONIC THEODOLITE. THE DATA FILE IS ARCHIVED ON DISC OR CD. WRITTEN FIELD NOTES MAY NOT EXIST. CONTOURS ARE SHOWN FOR CONVENIENCE ONLY. DESIGN SHOULD RELY ON SPOT ELEVATIONS.
2. ALL MONUMENTS SHOWN HEREON WERE LOCATED DURING THE COURSE OF THIS SURVEY UNLESS OTHERWISE NOTED.
3. THE TYPES AND LOCATIONS OF ANY UTILITIES SHOWN ON THIS DRAWING ARE BASED ON INFORMATION PROVIDED TO US, BY OTHERS OR GENERAL INFORMATION READILY AVAILABLE IN THE PUBLIC DOMAIN INCLUDING, AS APPLICABLE, IDENTIFYING MARKINGS PLACED BY UTILITY LOCATE SERVICES AND OBSERVED BY TERRANE IN THE FIELD. AS SUCH, THE UTILITY INFORMATION SHOWN ON THESE DRAWINGS ARE FOR INFORMATIONAL PURPOSES ONLY AND SHOULD NOT BE RELIED ON FOR DESIGN OR CONSTRUCTION PURPOSES; TERRANE IS NOT RESPONSIBLE OR LIABLE FOR THE ACCURACY OR COMPLETENESS OF THIS UTILITY INFORMATION. FOR THE ACCURATE LOCATION AND TYPE OF UTILITIES NECESSARY FOR DESIGN AND CONSTRUCTION, PLEASE CONTACT THE SITE OWNER AND THE LOCAL UTILITY LOCATE SERVICE (800-424-5555).
4. SUBJECT PROPERTY TAX PARCEL NO. 052405-9299.
5. SUBJECT PROPERTY AREA PER THIS SURVEY IS 33,813 ±S.F. (0.78 ACRES)
6. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE REPORT. EASEMENTS AND OTHER ENCUMBRANCES MAY EXIST THAT ARE NOT SHOWN HEREON.
7. EXISTING STRUCTURE(S) LOCATION AND DIMENSIONS ARE MEASURED FROM THE FACE OF THE SIDING UNLESS OTHERWISE NOTED.
8. FIELD DATA FOR THIS SURVEY WAS OBTAINED BY DIRECT FIELD MEASUREMENTS WITH A CALIBRATED ELECTRONIC 5-SECOND TOTAL STATION AND/OR SURVEY GRADE GPS OBSERVATIONS. ALL ANGULAR AND LINEAR RELATIONSHIPS ARE ACCURATE AND MEET THE STANDARDS SET BY WAC 332-130-090.

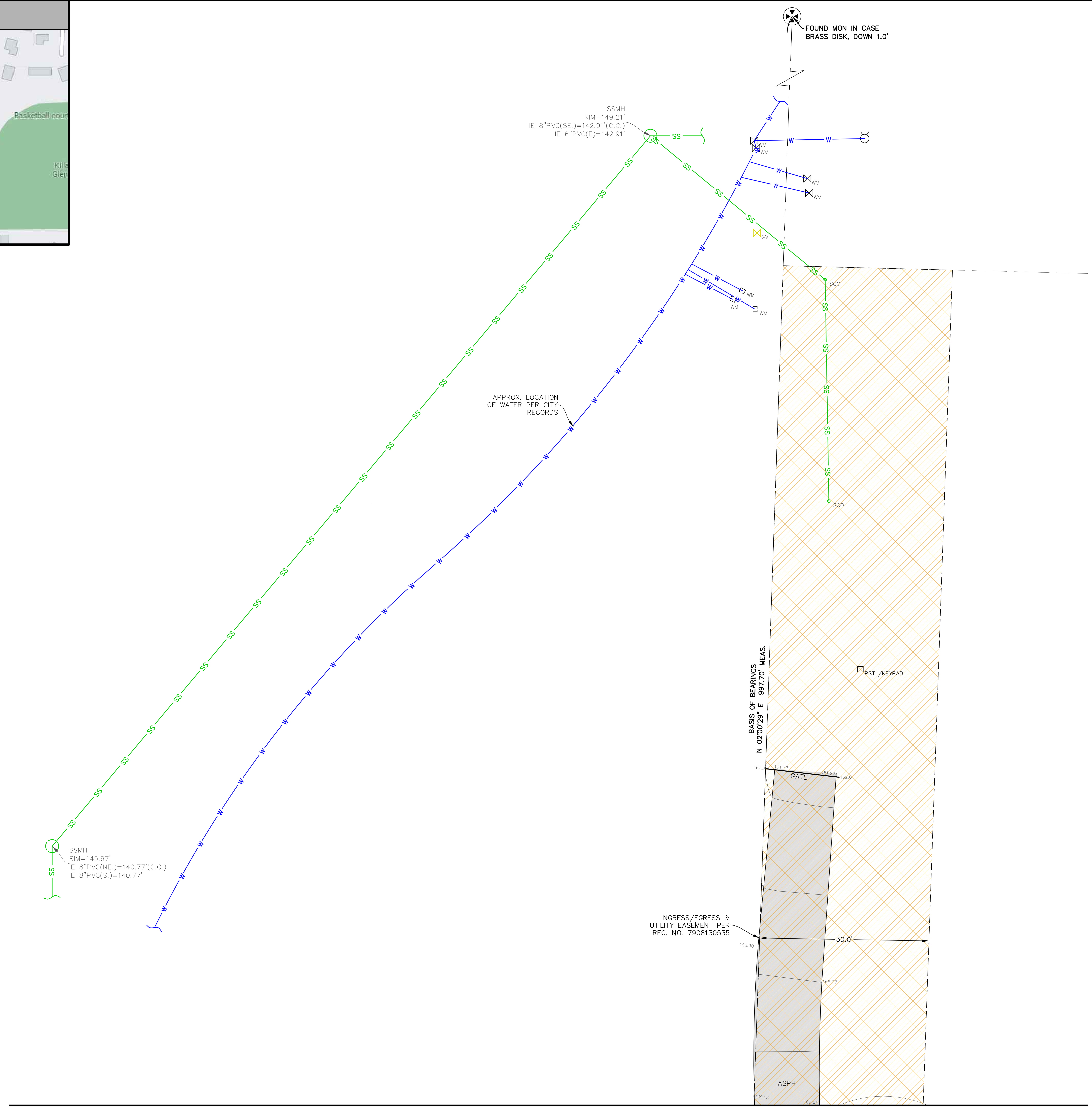
LEGEND

Symbol	Description	Symbol	Description
ACU	AC UNIT		MONUMENT IN CASE (FOUND)
	BENCHMARK	PST	POST
	AREA DRAIN		PAVER SURFACE
	ASPHALT SURFACE	GV	GAS VALVE
	BUILDING	P	POWER METER
℄	CENTERLINE ROW	UP	POWER (UNDERGROUND)
COL	COLUMN	PT	POWER TRANSFORMER
SCO	CLEANOUT		REBAR AS NOTED (FOUND)
	CONCRETE SURFACE		REBAR & CAP (SET)
	RETAINING WALL		ROCKERY
	DECK	SS	SEWER LINE
	FENCE LINE (CHAIN LINK)		SEWER MANHOLE
	FENCE LINE (WOOD)	TEL SENTRY	TELEPHONE SENTRY
	FIRE HYDRANT	SIZE TYPE	TREE (AS NOTED)
	FLAGSTONE SURFACE	W	WATER LINE
G	GAS LINE	WM	WATER METER
G	GAS METER	WV	WATER VALVE
	STEEP SLOPE AREA		INGRESS/EGRESS & UTILITY EASEMENT REC. NO. 7908130535

VICINITY MAP

N.T.S.

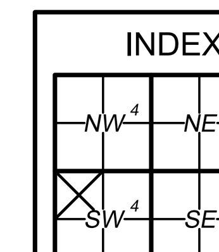




STEEP SLOPE/BUFFER DISCLAIMER:

THE LOCATION AND EXTENT OF STEEP SLOPES SHOWN ON THIS DRAWING ARE FOR INFORMATIONAL PURPOSES ONLY AND CANNOT BE RELIED ON FOR DESIGN AND/OR CONSTRUCTION. THE PITCH, LOCATION, AND EXTENT ARE BASED SOLELY ON OUR GENERAL OBSERVATIONS ON SITE AND OUR CURSORY REVIEW OF READILY AVAILABLE PUBLIC DOCUMENTS; AS SUCH, TERRANE CANNOT BE LIABLE OR RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ANY STEEP SLOPE INFORMATION. ULTIMATELY, THE LIMITS AND EXTENT OF ANY STEEP SLOPES ASSOCIATED WITH ANY SETBACKS OR OTHER DESIGN OR CONSTRUCTION PARAMETERS MUST BE DISCUSSED AND APPROVED BY THE REVIEWING AGENCY BEFORE ANY CONSTRUCTION CAN OCCUR.

INDEXING INFORMATION



NE 1/4 SE 1/4
SECTION: 05
TOWNSHIP: 24N
RANGE: 05E, W.M.
COUNTY: KING

We are the measure | terrane.net

TOPOGRAPHIC & BOUNDARY SURVEY
PARCEL NO. 0524059299

HARRISON RESIDENCE

1808 100TH AVE SE
BELLEVUE, WA 98004

TERRANE
10801 Main Street, Suite 102
Bellevue, WA 98004
p: 425-458-4488 | e: info@terrane.net

JOB NUMBER:	212286
DATE:	12/20/21
DRAFTED BY:	IDV/GKD
CHECKED BY:	JGM/DRT
SCALE:	1"=10'

REVISION HISTORY

SHEET NUMBER
1 OF 2

TOPOGRAPHIC & BOUNDARY SURVEY

MATCH LINE - SEE SHEET 1

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10 0 5 10
(IN FEET)
1 INCH = 10 FT.

INDEXING INFORMATION

NE 1/4 SE 1/4
SECTION: 05
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RANGE: 05E, W.M.
COUNTY: KING

LEGEND

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	BUILDING	P	POWER METER
	CENTERLINE ROW	UP	POWER (UNDERGROUND)
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measure success

TOPOGRAPHIC & BOUNDARY SURVEY

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SHEET NUMBER
2 OF 2